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AN APPROACH TO OVERCOME PROBLEMS IN UBIQUITOUS NETWORKS

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ABSTRACT

Nowadays networks have become more dynamic and pervasive. They have the capability to connect different types of networks in different inter networking environments. Ubiquitous network provides connection for the computing devices which can be connected to the network from any place and anytime. Ubiquitous networks consist of large number of heterogeneous nodes and variety of access networks. The meaning of the word ubiquitous in Latin means "present everywhere". The users will be provided with connectivity to the network everywhere and can access the content and can obtain computing anywhere. Ubiquitous networks will be providing seamless connectivity, and services can be provided to all nodes without worrying about the location and context. The ubiquitous networks have to ensure to provide connectivity anytime, anywhere and to anyone.

KEYWORDS: Ubiquitous Network, Wireless Networks, WiFi, WiMAX, Zigbee, IEEE

INTRODUCTION

These networks will be allowing the users to access and exchange information of any kind at anytime and from anywhere and from any mobile or stationary device through the use of broadband and mobile access. The module uses various interfaces like WiFi, WiMAX, Zigbee and other IEEE wireless standards as shown in Figure 1. The important requirement to transfer the application from one device to another device is to identify the user and the device near to him/her. This will be done by using the sensors.

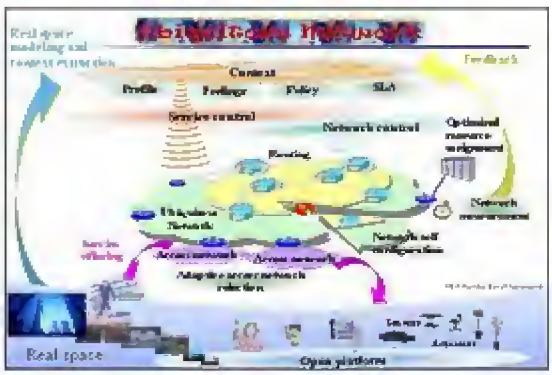

Figure 1: An Example Ubiquitous Network

So, ubiquitous network will avoid carrying your laptop or any other device. You can just access the application in the system which is near to you. So the application will also be in movement along with you. That is, you and the other nodes beside you will be detected and your application will be made available to you in the node which you are accessing. The user and also each devices will be having sensor tags. They should be connected to the Ubiquitous network middleware which will be managing all these sensor tags and sensors.

The ubiquitous networks is having special characteristics compared to computer networks, that includes the number of nodes, types of media used for communication, number of connected systems in the surrounding environment etc. The behaviour of ubiquitous networks cannot be predicted since they are large and complex. Lot of theories and algorithms are published on the properties of these networks and they will be implemented soon and available for our daily use.

Related Researches

- Ubiquitous networks should provide support to seamless connectivity and flexible services to all the connected nodes and also for the newly entering nodes.
- Allocating resources to all the nodes depending on the network availability is a big problem. There is a need to design and develop powerful algorithms for resource allocation.
- End-to-End flexible and adaptive routing has to be provided between the nodes. These nodes have to be automatically configured in order to work with the environment to which they enter.
- QoS in the network is a problem because of different technologies and services. Hence it is necessary to design and develop better algorithms for QoS management.

Characteristics of Ubiquitous Networks

Ubiquitous networks have different properties than computer networks in many aspects such as the following:

Nodes in Computer Networks

Similar computers which are used as nodes for communication with each other through standard protocols, such as TCP/IP, IEEE802 etc.

On the other hand, nodes and networks to be used for ubiquitous networks vary in amount of memory, hardware and software design, physical size, according to their needs and requirements.

Cheaper cost and longer operational time are often required from the nodes and networks. This means the ability of each node of the ubiquitous networks is very limited in many aspects such as computational power, memory capacity, access networks coverage, etc. While most of nodes in ubiquitous network are relatively simple, rich nodes can participate in the same networks simultaneously. Thus ubiquitous networks must mediate the communication between multiple nodes with significantly different abilities.

Network Media

For the same reasons mentioned above, the network media of ubiquitous networks are chosen in function of the requirements for the networks such as low power consuming, ease of installation, low running cost, and etc. The IEEE802 family, low power wireless networks, Power Line Communication (PLC), and telephone lines are used as access network for home networks. For sensor networks, low power wireless networks are used as access networks. The protocols used for communication are naturally different according to the access network media.

Large Number of Nodes

Ubiquitous networks consist of a large number of small nodes existing close to each other, and access networks for which typically low power wireless networks are used. Because of the relatively poor ability of the nodes and limited coverage of the access networks, the nodes must stay in close connection, work cooperatively, and communicate frequently with each other. Accordingly, the number of nodes in a certain area naturally becomes greater than that in regular computer networks.

Interaction with Surrounding Environment

In most applications of ubiquitous networks, nodes of the network tend to interact actively with the surrounding environment in many ways. For example, the role of sensor network nodes is normally to obtain some kind of information from the nearby environment, and communicate it to other nodes. The role of nodes in home networks may also include some kind of measurement which may impact on their own behavior. For the above reasons, interaction between the nodes and environments is important in ubiquitous networks.

Geographical Information

In computer network services, servers and clients can communicate with each other regardless of their location are. In other words, computer networks work without awareness of location. In contrast, location of nodes is significant for ubiquitous networks. For example, in sensor networks the location of nodes is one of the most important information which the nodes have to tell each other because the information is inseparably related to their location.

Persistency of Network Topology

The topology of sensor networks is changes from time to time when mobile ad-hoc networks are used as access networks because of the condition of signal propagation and routing algorithm. Changing the topology may cause packet loss or sometimes increase of delay and latency.

EXISTING METHODS

The aim of the ubiquitous network is to provide seamless connectivity. The number of nodes will be very large. Large numbers of small nodes are connected and the requirements of the nodes will also be different. The mobile wireless networks have gained popularity in recent years because of its availability and pervasiveness. The future of these wireless network is expected be having variety of networks of different coverage ranges like Wireless Metropolitan Area Network (WMAN) and Wireless Local Area Network (WLAN) since they provide cheaper and better wireless coverage [1]. The algorithm has been proposed to integrate these WMAN/WLAN technologies to provide better QoS. The algorithm is based on bandwidth allocation technique along with Space Division Multiple Access (SDMA) technique [1].

Network management refers to the activities, tools, procedures and methods to maintain the operation, provisioning, maintenance and administration of networked system. Operation of the network deals with maintaining the normal operation of the network to continue to run smoothly by detecting the problems as soon as possible before the users are affected. In case of Ubiquitous networks, the connected devices will be spread over a large area and so there is a challenge in order to maintain the normal operation of the network. Provision in network means providing network access

to the newly added node or existing nodes by configuring the resources. In case of Ubiquitous Networks, a novel resource discovery mechanism can be used for ubiquitous environments using resource index nodes and mobile agents [2].

Maintenance is concerned with performing repairs and upgrades to the hardware and software which are used in ubiquitous network. Since the nodes are of different types, there is a need to develop an algorithm to identify all the attached nodes in the network and to maintain them by automatically detecting neighbouring nodes and configure itself.

Administration deals with managing the resources in the network and their task assignment. Currently used ad-hoc protocols cannot be used in case of ubiquitous networks. So there is a need to develop an Unmanaged Internet Protocol (UIP) which manages itself whenever a new node is added to the network [3]. It is based on configuring the nodes automatically and manages the hierarchical address. The routing algorithm in proposed work is adapted from distributed hash tables.

Critical study has been conducted to determine the fast handover for IPv6 users. Several QoS performance parameters are evaluated and proposed in paper [4].

An IP-based multi-parametric approach for end to end QoS provision has also been developed in paper [5]. The work of this model laid emphasis on dynamic analysis. In the proposed model, the MPLS properties are used in the QoS decision engines to make it a unique method.

A model based on OSI model has been proposed in order to provide seamless mobility in ubiquitous network environments for service users [6]. By using the proposed model, the users can access network according to their requirement and they can select in different coverage plans.

In [7], the authors proposed a optimized method for network usage for next generation networks with reconfigurable plan for network resources. In the framework, high organized resource management and handover is performed for QoS maintenance.

The various issues concerned with the Ubiquitous network management are

- **Network Routing and Control:** Includes providing various network services flexibly, comfortably and seamlessly. Network Routing includes the different handover techniques like low latency handover and loss-less handover. This also includes End-to-End QoS routing. End-to-End flexible routing is based on the Service Level Agreements between the various network providers. Based on the requirements of application, adaptive routing has to be done in the network. The adaptive routing is helpful because of different types of applications. The routing of nodes between different networks has to be done based on the status of network.
- **Support for Mobility:** The existing nodes in the network must be able to operate in various environments and dynamically adjust to the changes in the computation environment. Whenever a new node tries to enter the network, it should be added to the network by calculating the availability of the channels.
- **Network Service Control**: Includes the management of network resources and network services. Uniform service has to be provided to all the nodes. But there is a need to prevent certain services to which the node is not registered.

- **Network Self Configuration:** The ubiquitous network will be having sensor nodes which will be keeping track of the changes in the mobility of the device and the configuration will be taking place according to the environment to which the node enters.
- **Adaptive Service Control:** Includes collection and management of network context and application context. Ubiquitous network has to provide various services to the user which is easily and safely adaptive to the user's context without any complicate operation.
- **Context Awareness:** Context includes who? Where? And when? The devices in the ubiquitous network should be aware of the environment in which they are working as well as the tasks that the user is performing.
- **Profile Management:** A best service has to be provided to the user based on the profile and context. i.e., depending on the environment where the user is present, the services have to be provided differently.

The ubiquitous network management faces new challenges along with the challenges faced by the traditional networks. The main challenges in ubiquitous network management are:

- **Seamless Connectivity:** The challenge of seamless connectivity in the ubiquitous networks means, the network should be always connective to the user nodes in all environments. This includes vertical handoff between different networks. Vertical handoff is the handoff taking place between different types of networks. The network characteristics like bandwidth should also be maintained to achieve seamless connectivity. Network interface management which includes data flow control like bandwidth aggregation and network availability which can be achieved by vertical handoffs. The Interface co-existence includes designing the new set of rules or protocols for providing good QoS based on selected interface. New rules and handoff policies should be included in order to achieve vertical handoff [9].
- The devices in the network should have the ability to recognize different available networks. For example, there will be different networks like WiFi, GPRS, WiMax, 3G, 4G etc. The devices should select appropriate network among these available networks [10].
- When the device changes from one network to another network, the IP address has to be changed.
- The device should change and adopt itself to the network characteristics of the environment to which it enters.
- If there is no network available for the device to connect, the device should try to connect to another device in the network in Ad hoc model by trying to connect itself to its neighbouring nodes.

So, to manage the ubiquitous network, it has to manage the core network, access network, ubiquitous appliances and sensors. Seamless connectivity can be achieved by managing the vertical handoff intelligently in an optimal way. Ubiquitous networks can be successfully implemented by achieving adaptation of the devices to take connectivity action whenever necessary and also achieving context awareness.

New technologies in network management need to be explored in order to maintain pace with the recent growth of mobile environment and ubiquitous network environment. To achieve this, Mobile IPv6-MIB has been proposed as the core technology at the IETF. In [8] the functionalities of Mobile IPv6-MIB has been explained and Guest Node Monitoring

is discussed as a new concept for ubiquitous network management. The authors have also focused on the problem of monitoring guest nodes attached to the management domain. A novel model is proposed for guest node monitoring based on Mobile IPv6-MIB since it is very difficult for the local manager to manage all the connected devices directly.

PROPOSED SYSTEM

- The main objective of the work is to develop an algorithm to provide seamless connectivity to all the nodes in the network. Next, the framework should be developed to allocate the resource reliably to the nodes newly entering the network.
- The existing nodes in the network should be able to adjust dynamically and calculate the availability of the network and select and work in that environment.
- The data transmission should be accurate and reliable among all the nodes in the network.

It means there is a need for optimal solution. This solution has to monitor the availability of the network, and whenever there is a need for handover, it should also recognize the best available network. Generally, the vertical handoff between two networks depends on the application based QoS, bit error rates, coverage area and signal strength. The research work has to propose a QoS framework for ubiquitous wireless networks and has to compare and analyze the performance and make optimal decisions in network selection.

Implementation

The framework provides solution for resource allocation to the newly entered nodes in the network. This can be done by detecting the newly entered node and when it requests for service from the base station, the base station has to reply back with the available bandwidth, protocols. The proposed framework will select the suitable network among the available networks. The decision depends on QoS specific criteria for applications. The computational intelligence should be used to customize the network selection and achieve optimal application specific performance.

Since ubiquitous network requires new securities, we will be using the emerging technologies with the existing technologies to provide security in the network. In this way, a high level of transparent security should be provided for the network users. Methodology for network selection in ubiquitous network is shown in Figure 2.

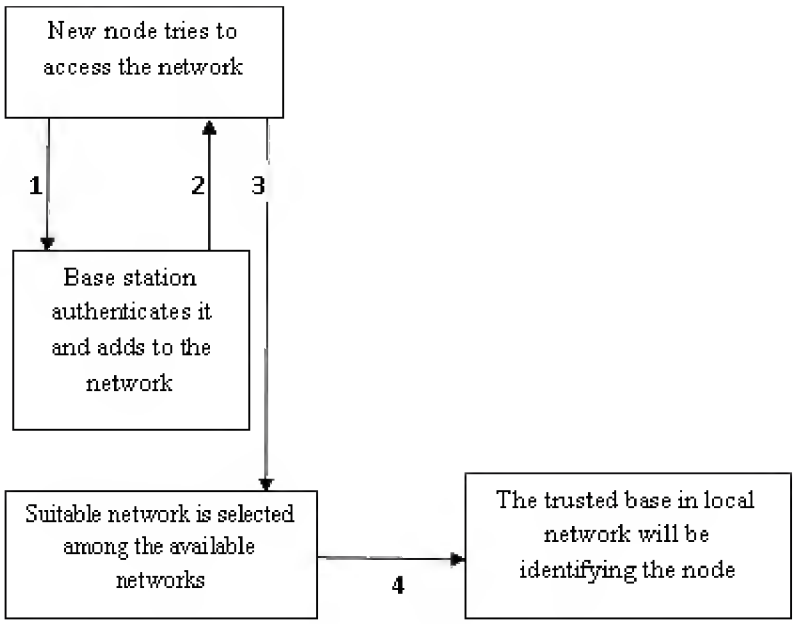

Figure 2: Seamless Connectivity in Ubiquitous Network

CONCLUSIONS

The most fundamental element of this work is to provide seamless connectivity to the newly entering nodes. The resource allocation has to be done to the nodes depending on its requirement and availability. Performance of each node should be improved, Adding security enhancements and provide security against possibly malicious environment. In addition to this, effective enforcement measures and security policies will be included in this architecture. The intrusion will be detected at the node level and it can be done by creating an interface. So in this way, the nodes can be added to the network or rejected from entering the network by developing an authentication technique to authenticate the entering nodes by combing the security algorithm with existing algorithm.

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